

Notice of Allowability

Application No.

10/767,136

Examiner

Jennifer M. Dolan

Applicant(s)

BAEK ET AL.

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to Amdt. 11/21/05.
2. ☒ The allowed claim(s) is/are 1-8.
3. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☒ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☒ Certified copies of the priority documents have been received in Application No. 10/232,344.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____


CARL WHITEHEAD, JR.
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800

DETAILED ACTION

1. Claims 1-8 are allowed.
2. The Examiner generally agrees with the Applicant's remarks filed on 11/21/05, and further offers the following statement on reasons for allowance:

The primary reason for allowance is the claimed combination of forming a plurality of void pads of a material non-wettable by solder or a thermal interface material (TIM), disposing a solder or TIM preform, and then re-flowing the solder or TIM to create a plurality of voids within the solder or TIM, the voids aligned with the void pads, and the solder and voids being disposed on the side of a chip opposite to the mounting substrate.

Conventionally in the art, a single, un-voided, and contiguous mass of solder or TIM is applied on the backside of a chip, with a heat sink or a lid attached thereon. This approach generally provides good thermal conductance, but relatively poor thermo-mechanical stress relief, as is noted by the Applicant (see pages 1-2 of the Specification).

The closest prior art, such as US 6,437,240 to Smith or US 6,245,186 to Alcoe, uses a ball-grid type structure formed of solder to provide both thermal conductance and stress management. Since Smith and Alcoe teach the use of discrete conductive masses surrounded by a compliant material, they are a fundamentally different geometry than the claimed plurality of voids aligned with a plurality of void pads in the solder pre-form layer. Furthermore, since the specific shape and dimensions of the solder balls in Smith and Alcoe directly relate to the compressibility of the solder layer, and hence, the stress management, it is the Examiner's opinion that a person skilled in the art would not be motivated to change the geometry of the

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solder ball layer, as would be required to meet the limitations of the present claims, at the risk of destroying the intended function disclosed by Smith and Alcoe.

The only teaching in the prior art that could be considered to correspond with the claimed plurality of voids formed over a plurality of non-wettable void pads by re-flowing a solder or TIM material is that taught in US 6,486,499 to Krames et al. (cited herewith, see figure 11(b) and column 9, in particular). Krames, however, is drawn to a structure for providing both electrical and thermal conduction, rather than the purely thermal conduction structures in the most relevant prior art, such as Smith or Alcoe. Since Krames fails to provide any specific motivations for using the figure 11(b) type structure including the void pads as a purely thermal interface material or on the side of the chip opposite to the connection substrate, and since the geometries in Smith and Alcoe are critical for fulfilling the thermal stress management functions disclosed by Smith and Alcoe, it is the Examiner's opinion that there is insufficient motivation for combining any of the prior art references to arrive at the claimed invention.

3. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer M. Dolan whose telephone number is (571) 272-1690. The examiner can normally be reached on Monday-Friday 8:30am-5:00pm.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl W. Whitehead, Jr. can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jennifer M. Dolan
Examiner
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